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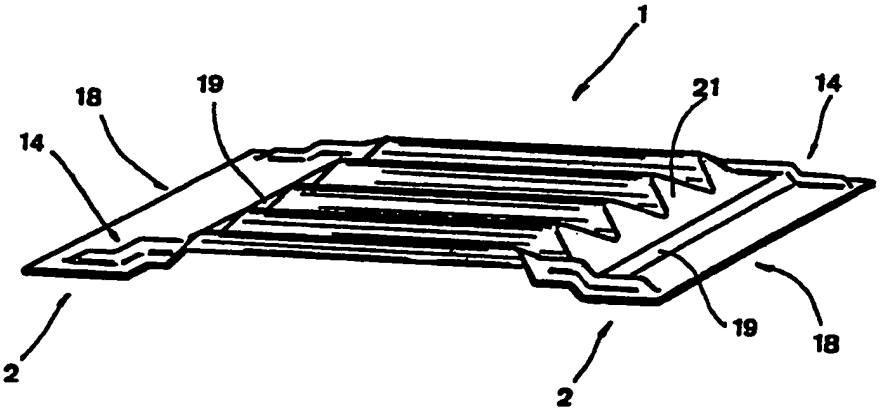
(54) Title: ROOFING FOR BUILDINGS, COVERED WITH INSULATING AND/OR WATER-PROOFING MATERIAL AND APPLYING TRANSPARENT SKYLIGHT PANELS



(57) Abstract

The roof covering made up of opaque, corrugated or flat panels arranged along the pitch and laid on the frame (8) is made up of one or more transparent skylight panels (10), designed to avoid concave gaps when the surrounding opaque panels are covered with insulating and/or water-proofing material (9) of a thickness ranging from 2 to 6 cm; the transparent panel has a mid section (1) raised above the two ends (2) and joined to the opaque panels (7) upstream and downstream, by a pair of coupling sections (3) inclined at an angle of 15° to 60° from the vertical axis; the height of the raised section depends on the thickness of the covering; the raised mid section (1) prevents water from collecting and can be combined to form air chambers; a double pair of longitudinal ridges (14) protrude from the ends of the panel, with concave base construction (25); a ledge (11) is fitted between the transverse edges of the panel ends and the raised mid section (1), anchoring the water-proofing layer (20); this roofing system is suitable for use in civil and/or industrial buildings.

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Roofing for buildings, covered with insulating and/or water-proofing material and applying transparent skylight panels.

The invention relates to roofing for buildings, covered with insulating and/or water-proofing material and transparent skylight panels, that is, a new type of sloped roofing for civil and industrial buildings, formed by either flat or corrugated panels, in both cases profiled, made from asbestos cement, aluminium, steel or any other suitable material, either covered after laying, with insulating and/or water-proofing material, or resting on insulating material and covered with water-proofing material; panels interrupted by openings to allow passage of light: these openings are covered by a transparent panel, as devised by the invention, such panel being the subject of this application for patent rights.

Techniques used include skylights formed from transparent, fiber glass panels, with either a flat or corrugated transverse section, and forming a continuous surface with opaque panels positioned close to them, over the pitch of the roof; they also include skylights formed from a pair of transparent panels, either corrugated or flat depending on the particular case, possibly reinforced, laid parallel with the pitch of the roof and above the transverse counterlaths, to form an insulating air chamber; this does not however, provide a satisfactory thermal seal as the panels are anchored to the frame or support with nails and screws.

If the roof is covered with a layer of insulating and/or water-proofing material, either spray-applied or in panel form, fitted after laying, concave gaps in the roofing of an intolerable size tend to form near the skylights, due to the excessive lifting of the rainwater run-off surface; this means that the covering on the roof has to be extended to the area planned for the window and light can therefore no longer pass through the roof; otherwise it involves the construction of dome-shaped skylights, either transparent or transparent, a process which is both time-consuming and costly.

There is another type of roof covering where the panels, rather than being laid directly onto the roof surface, are resting on an insulating layer, fixed to the surface of the roof; in this way, the covering on the upper surface of the panels is limited to a water-proofing layer, of bitumen for example.

This method is also inconvenient for the reasons mentioned above, or for similar reasons.

These techniques are open to considerable improvement in order to avoid the problems referred to. It appears from the above that these technical problems need to be resolved by discovering a form of roof covering made up of opaque panels, in any material and suitably profiled, corrugated or flat, or in the form of large flat tiles, which allow a window effect to be maintained, even when insulating and/or water-proofing materials have to be applied to the panels; these transparent skylight panels covering the roof must also prevent penetration of rainwater, particularly in a transverse direction; the panel should also be suitable for use on rooves where the opaque panels are simply covered with a layer of water-proofing material and any insulating material is applied underneath the panel, fixed to the supporting structure; with this type of panel, skylights with insulating air chambers or cavities could also be used.

The invention resolves the above mentioned technical problem, adopting a form of transparent skylight panel whose two supporting ends have the same transverse section profile as the opaque panels, either flat or corrugated; the mid section however, is raised to a height above the ends of at least the thickness of the insulating and/or water-proofing layer covering the opaque panels: this mid section can have either a flat or corrugated transverse section; the mid section is joined to the two ends by two symmetrical sections, inclined at an angle of between 15° and 60°, diverging downward; the ratio between the length of the raised mid section and the total length of the transparent skylight should be between 0.6 and 0.9.

The two ends of the transparent skylight panel, with raised

mid section between them, can also be supplied with a pair of longitudinal ridges along their lateral edges and along the crest if the panel is corrugated; these ridges have a concave base with the two sloped sides converging upwards to a fairly uniform height, at least at the centre and towards the outer end; for panels which are covered on their upper surface with only a layer of water-proofing material, their lower surface resting directly on the roof, each of the two ends is fitted with a ledge positioned between the transverse edges of the panel end and the raised mid section, forming a coupling element between the panel and the under surface of the water-proofing edge.

Finally skylights with air chambers produced by the cavity formed between the raised mid sections of two transparent panels are also available; the cavity is formed either by placing the two panels, one on top of the other with the concave section turned inward or by pairing a panel designed in accordance with the invention, with a flat traditional type panel, the second preferably underneath the first.

The advantages of this invention are: the elimination of concave gaps in the roof, yet at the same time preserving the window effect, with or without an air chamber; more spacious, heat-sealed chambers can also be obtained; economic savings from the conservation of the roof covering, without having to replace the panel skylights with dome models or carry out building works; elimination of any transverse penetration of water through the lateral joints between panels; possibility of applying transparent skylight panels as devised by the invention, whose upper surface is covered with a layer of water-proofing material only.

Some of the ways in which the invention can be used are illustrated, purely by way of examples, in the eighteen sketches attached, where: Figure 1 is a view in prospective of fiber glass panel for skylight roof covering, with corrugated transverse profile and longitudinal profile with raised section, as devised by the invention; Figure 2 is a view, like Figure 1, but illustrating a fiber glass panel for skylight roof covering, with fretted transverse profile,

particularly suited for coupling with aluminium roofing panels; Figure 3 is a view, like Figure 1, but illustrating a fiber glass panel for skylight roof covering, with peaked transverse profile, particularly suited for coupling with aluminium roofing panels; Figure 4 is a view, like Figure 1, but illustrating a transparent panel for skylight roof covering with flat end sections; Figure 5 is the longitudinal section of the crest of the corrugated panel illustrated in Figure 1; Figure 6 is the partial, enlarged and interrupted transverse section VI-VI of Figure 1; Figure 7 is a view in prospective of a fiber glass panel for skylight roof covering, composed of a fiber glass panel with corrugated transverse section and flat longitudinal section and a fiber glass panel with the same transverse profile, but a longitudinal profile with raised mid section as illustrated in Figure 1, also devised by the invention: the two panels are in contact with each other at their ends and can be fitted either as illustrated in the diagram or the other way round; Figure 8 is the vertical longitudinal section, taken through the lower generatrix, of a roof covering made up of skylight panels as illustrated in Figure 1, resting on metal, transverse sections whose surface is treated with polyurethane foam for example, to form an insulating layer of a thickness equal to the difference in height between the base surface and the raised surface of the transparent panel, for example between 2 and 6 cm; Figure 9 is a section as illustrated in Figure 8, yet in this case, resting on tiles or asbestos cement, with wooden transverse strips; Figure 10 is a section, as illustrated in Figure 9, but with concave transparent panels placed together to form an air chamber; Figure 11 is the transverse section XI-XI, partial and enlarged, of Figure 8; Figure 12 is the transverse section XII-XII, partial and enlarged, of Figure 9; Figure 13 is the transverse section XIII-XIII, partial and enlarged, of Figure 10; Figure 14 is a view in prospective of a transparent panel, in fiber glass, for skylight roofing as devised by the invention, with a corrugated transverse profile and a longitudinal profile

with raised mid section, as shown in Figure 1, but also fitted with two pairs of longitudinal ridges at the base ends designed to prevent lateral penetration of water; Figure 15 is a view in prospective, as in Figure 14, but in this case the transparent fiber glass panel has a fretted transverse profile; Figure 16 is a view in prospective, as in Figure 14, but in this case the transparent fiber glass panel has a peaked transverse profile; Figure 17 is a view in prospective, as illustrated in Figure 14, but with flat supporting ends; Figure 18 is the vertical longitudinal section, taken through the lower generatrix, of a transparent panel forming part of a roof covering composed of opaque corrugated panels, covered with polyurethane foam; Figure 19 is the enlarged rear view section XIX-XIX of Figure 18, illustrating the coupling joint between two adjoining panels; Figure 20 is a view in prospective as illustrated in Figure 17, but fitted with a ledge between the flat supporting ends of the transparent panel and the raised mid section; Figure 21 is the longitudinal section, enlarged, along one crest of the corrugated panel illustrated in Figure 20, at the section joining the raised mid section with the end; Figure 22 is a section like the one illustrated in Figure 21, but illustrating the longitudinal ridge along the end section; Figure 23 is a view from the left of Figure 22, but illustrating the coupling joint between two adjoining panels; Figure 24 is a view like the one in Figure 20, but relating to a panel without a ledge, to be applied on top of a layer of insulating material to cover it, whilst the earlier figures related to panels whose ends are later covered by the insulating layer; Figure 25 is a section, like the one in Figure 21, but relating to the panel in Figure 24; Figure 26 is a section like the one in Figure 23, relating to the panel in Figure 24; Figure 27 is a view from the left of Figure 24, showing the coupling joint between two adjoining panels; Figure 28 is a view, like the one in Figure 24, but with corrugated supporting ends; Figure 29 is a section, like the one in Figure 21, but relating to the panel in Figure 28; Figure 30 is a section

like the one in Figure 22, but relating to the panel in figure 28; Figure 31 is a longitudinal section, enlarged, taken through the lower generatrix of a crest in the corrugated panel shown in Figure 28; Figure 32 is a view from the left of Figure 30, but showing the coupling joint between two adjoining panels; Figure 33 is a vertical longitudinal section taken through the crest of the transparent panel in Figure 20 of a roof covering composed of flat panels or flat tiles, covered with polyurethane foam, with an outer layer of water-proofing material; Figure 34 is a section , like the one in Figure 33, but relating to the panel in Figure 24, resting on an insulating layer and provided with an outer layer of water-proofing material; Figure 35 is the longitudinal section of a transparent panel for skylight roofing, with insulating air chamber, composed of an upper panel as devised by the invention and illustrated in Figure 28, and of a flat traditional-type lower transparent panel; Figure 36 is a section like the one in Figure 35, in which the lower panel has been replaced with a transparent panel having the same profile as the upper one, yet without longitudinal ridges; Figure 37 is a section, like the one in Figure 35, obtained with panels like those shown in Figure 24, the lower of which has no longitudinal ridges; Figure 38 is a section, like the one in Figure 37, obtained with panels like those shown in Figure 20.

The indications are as follows: 1 is the raised mid section of the transparent panel with supporting ends, 2; 3 is a pair of sections, inclined at an angle between, for example, 15° and 60° from the vertical axis and diverging downward, joining the pair or corrugated transverse ends 2 with the raised mid section 1; 4 (Figure 6) is the core,in either glass fibre or fabric, of the transparent panel; 5 are the outer layers of the panel, usually in transparent resin; 6 (Figure 7) is a traditional corrugated transparent panel, forming an air chamber C with another panel 1, 2, 3; 7 (Figure 8) are the opaque corrugated panels resting on metal transverse sections 8, covered with polyurethane foam 9, the

ends designed to support the ends of the adjoining panels constructed in accordance with the invention; 10 is the opening, or window, in the skylight; 11 (Figure 9) are the transverse wooden strips resting on the roof 12; 13 (Figure 4) are the flat ends of a mixed panel, with corrugated mid and joining sections; 14 (Figure 14) are the longitudinal ridges formed bilaterally along the crest of the supporting ends, in order to channel water along the panel, each consisting of a pair of sloping sides 15 (Figure 19) converging upwards and forming an angle of 90° for example: the longitudinal profile of these ridges, at least at the centre and towards the outer end, is more or less of a uniform height, of a few centimeters, for example; 16 are the opaque corrugated panels resting on the metal transverse sections 17, covered with polyurethane foam 9 to form an insulating layer; 18 (Figure 20) are the pairs of supporting end elements, used to fix each panel 1 onto the roof, also fitted with longitudinal ridges 14 disposed bilaterally along the end sections; 19 are the pairs of transverse ledges, either continuous or interrupted, placed between the end elements 18 and the raised mid section 1, to secure the water-proofing layer 20 (Figure 21), often consisting of a bitumen coating; 21 are the inclined surfaces joining the ends of the raised mid section 1 to the supporting ends 18; H (Figure 21) is the difference in height between the surface which rests on the roof and the ledge 19, of between about 2 cm and 5 cm: K is the overall height of the panel, being between about 8 cm and 12 cm; K1 (Figure 25) is the overall height of the panel in the version without transverse ledge, between about 5 cm and 7 cm; 22 is the layer of insulating material, applied to the upper surface of the roof and therefore lying between the roof and the flat end of the panel or the flat tile 23; 24 is the pair of supporting ends of the skylight panel, with corrugated longitudinal section and coupled with the ends of the adjoining opaque corrugated panels; 25 are the cavities formed by each longitudinal ridge 14, outlined above, by a pair of sloping sides, and left open below, to allow the

panels having the same profile to be stored, stacking them one on top of the other.

The panels described in the invention are installed by fitting the pair of corrugated transverse end sections 2 or surfaces 18 directly onto the upper surface of the roof, followed by covering with a layer of insulating material, forexample polyurethane; the panels are coupled by resting the lateral edges of one panel on top of the adjoining panel; the water-proofing layer 20 is applied on top of the insulating layer, with the coupling elements attached to the panel by means of a pair of ledges 19.

In practice, the materials, sizes, executive details, can differ from those indicated, provided they are technically equivalent, without going beyond the legal scope of this invention.

In this way the longitudinal ridges, either of hollow construction integral with the panel, or solid, referred to above, can be fitted at the tips of the supporting ends 2, 18, by welding or gluing for example.

CLAIMS

1. Roofing for buildings, using insulating and/or water-proofing material and transparent skylight panels, consisting of transparent skylight panels with either a corrugated or flat transverse profile, arranged in transverse strips along the pitch of the roof and characterised by the following: provided with at least one transparent skylight panel whose two supporting ends are either flat or shaped, depending on the transverse profile of the opaque panels of the roof itself: each transparent panel has a mid section (1) raised above the two supporting ends by an amount equal to or exceeding the thickness of the insulating and/or water-proofing layer covering the surrounding opaque roof panels; this mid section is joined to the two ends by two symmetrical sections inclined at an angle of between 15° and 60° from the vertical axis, diverging downward.

2. Roofing, according to claim 1 characterised as follows: skylight with air chamber (C), with the ends (2) of the transparent panel with raised mid section (1) joined to the like ends of another transparent panel with the same transverse section and mid section (1), their concave sections lined up: the ends of the two panels are then joined to the ends of the two opaque roof panels below (7), one upstream and the other downstream, having the same transverse profile.

3. Roofing, according to claim 1 characterised as follows: skylight with air chamber (C), with the ends (2) of the transparent panel with raised mid section (1) joined to the like ends of a traditional panel, flat above or below with the same transverse section: the ends of the two panels are then joined to the ends of the two opaque roof panels below (7), one upstream and the other downstream, having the same transverse profile.

4. Roofing, according to claim 1, characterised as follows: two ends (2, 18) of transparent skylight panel, with raised mid section (1) joined to the ends; a pair of longitudinal ridges protrude along the lateral edges of the panel, along

the crest if the panel is corrugated.

5. Roofing, according to claim 4, characterised by a skylight with air chamber as follows: the ends of the transparent panel with raised mid section are joined to the like ends of another transparent panel with the same transverse profile and mid section, their concave sections lined up: the ends of the two panels are then joined either to the ends of the two opaque roof panels below, having the same transverse profile, or the upper surface of the flat tiles, or of the flat sections, in the case of panels with flat ends.

6. Roofing, according to claim 4, characterised by a skylight with air chamber as follows: the ends of the transparent panel with raised mid sections, at least one of which is provided with a ledge between the transverse edges of the panel end and the raised mid section, are joined to the like ends of another transparent panel with the same transverse profile, with or without the ledge, without longitudinal ridge, their concave sections lined up: the ends of the two panels are then joined either to the ends of the two opaque roof panels below, having the same transverse profile, or the upper surface of the flat tiles or of the flat sections, in the case of panels with flat ends.

7. Transparent panel, according to claim 1, characterised as follows: fitted with two flat (13) or corrugated (2) supporting ends: these ends are joined to a raised mid section by two symmetrical sections inclined at an angle of between 15 and 60° from the vertical axis, diverging downward.

8. Transparent panel, according to claim 1, characterised as follows: fitted with a raised mid section (1), joined to the two ends (2); the ends are flat and the sections lying between them have either a totally or partially corrugated profile.

9. Transparent panel, according to claim 1, characterised as follows: fitted with a raised mid section (1), joined to the two ends (2); the ends have a corrugated profile and the sections lying between them have either a totally or

partially flat profile.

10. Roofing panel, according to claim 4, characterised as follows: fitted with longitudinal ridges whose base is either hollow in construction (14) or solid, each consisting of a pair of sloping sides (15) converging upwards to a more or less uniform height, at least in the centre and towards the outer end.

11. Panel, according to claim 10, characterised as follows: covered with a water-proofing layer only (20) and possibly an insulating layer (22) underneath the lower surface supported by the roof; at least one of the two ends (2, 18) has a transverse ledge (19) positioned between the transverse edges of the end and the raised mid section (1), to secure the panel to the lower transverse edge of the water-proofing layer (20).

12. Panel, according to claim 11, characterised as follows: distance (K1) between the laying surface and the surface tangentially arranged with respect to the upper profile of the panel is between about 5 cm and 7 cm.

13. Panel, according to claim 11, characterised as follows: distance (K) between the laying surface and the surface tangentially arranged with respect to the upper profile of the panel is between about 5 cm and 7 cm.: the difference in height between the laying surface and the transverse ledge (19) corresponds to the height of the insulating layer (22), and is between approximately 2 cm and 6 cm.

14. Transparent panel, according to one or more of the above claims, characterised as follows: the ratio between the length of the raised mid section (1) and the total length of the panel might be between 0.6 and 0.9.

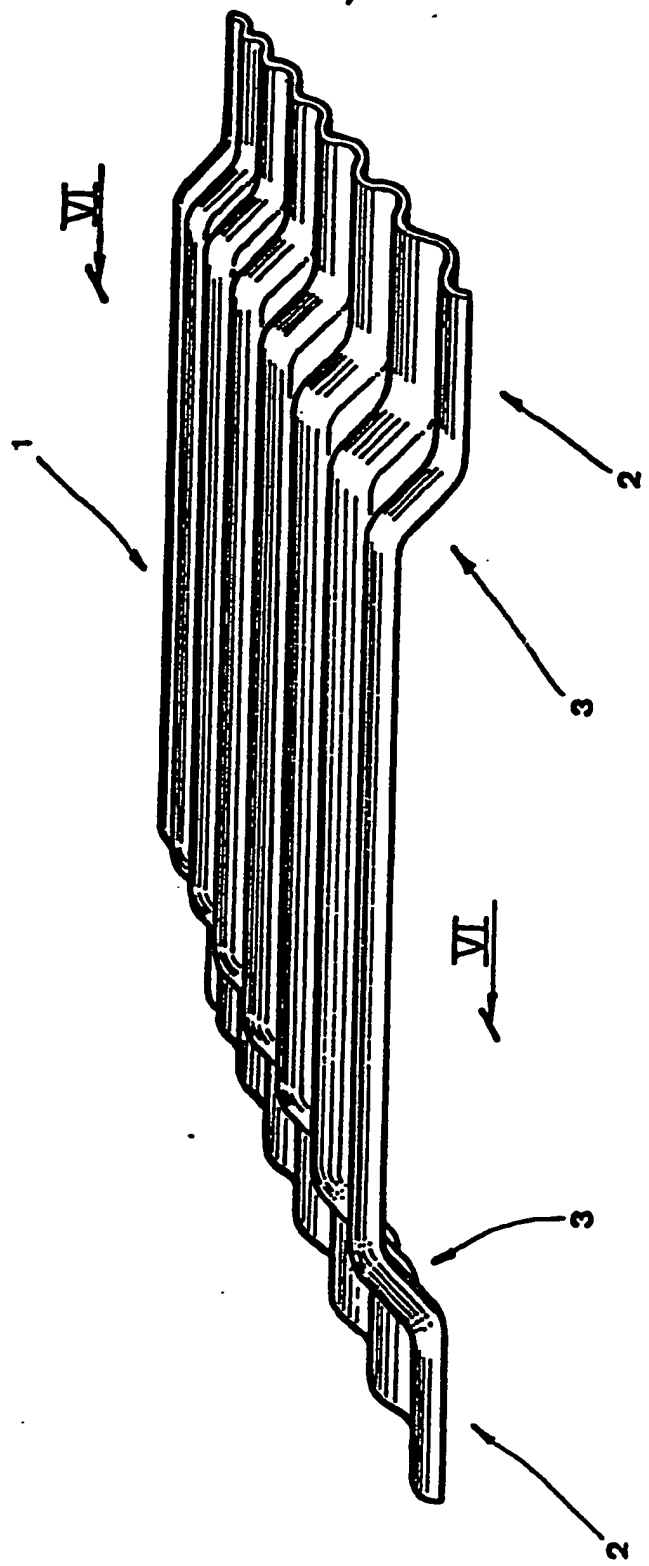


Fig.1

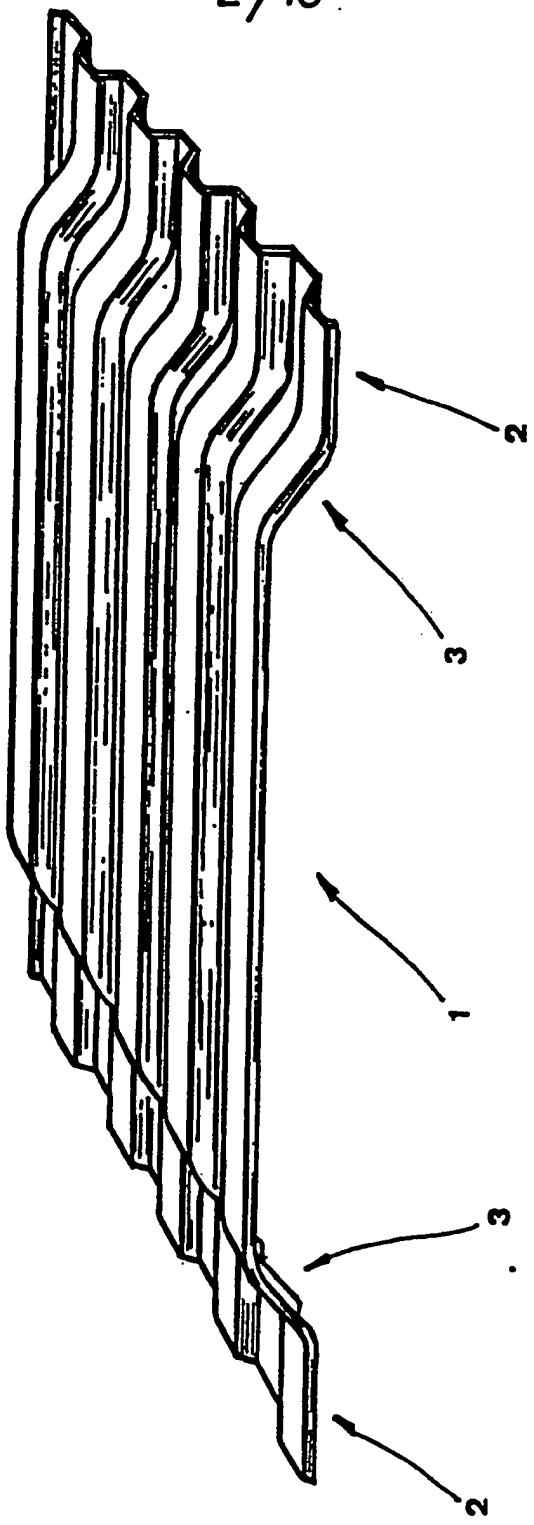
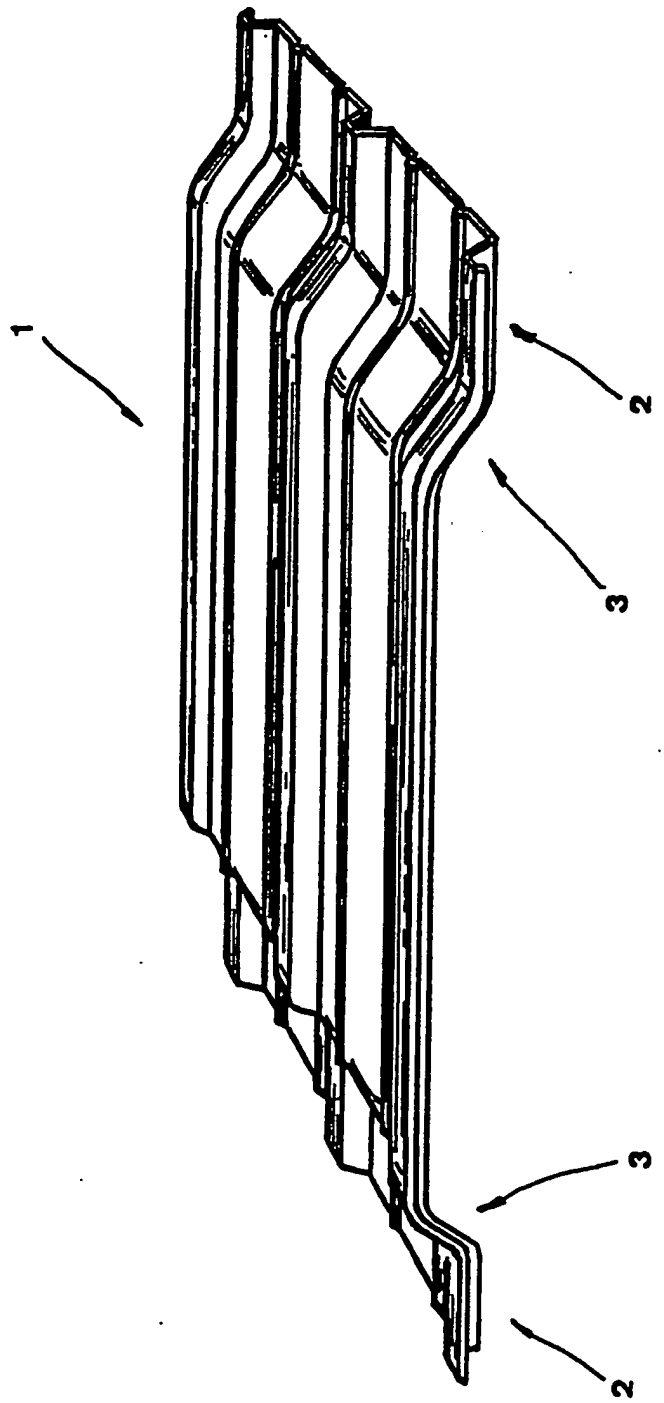


Fig.2



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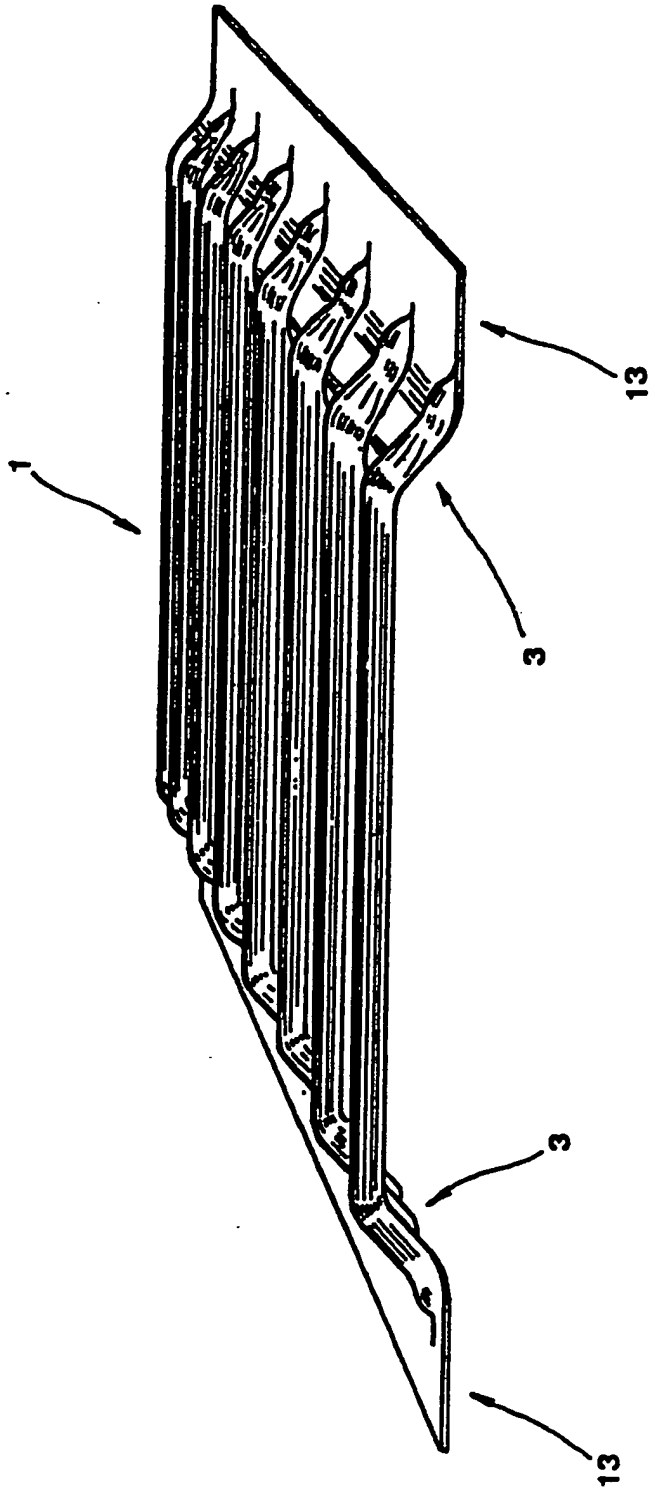


Fig.4

Fig.5

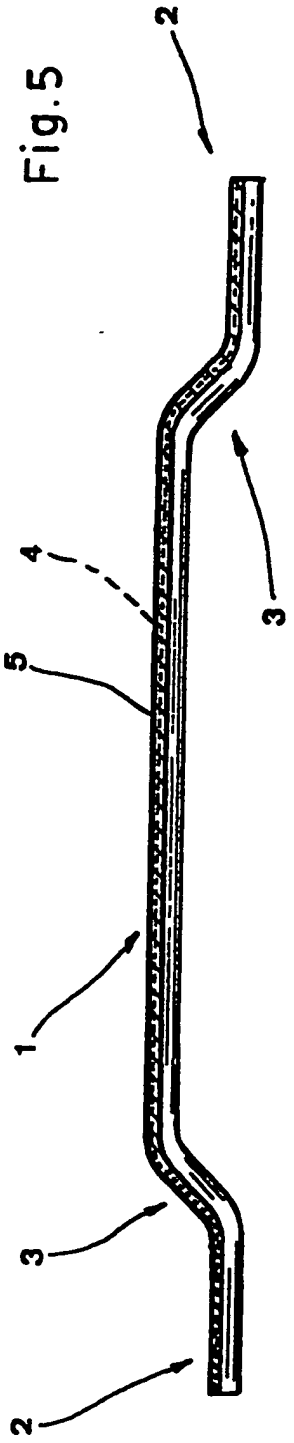
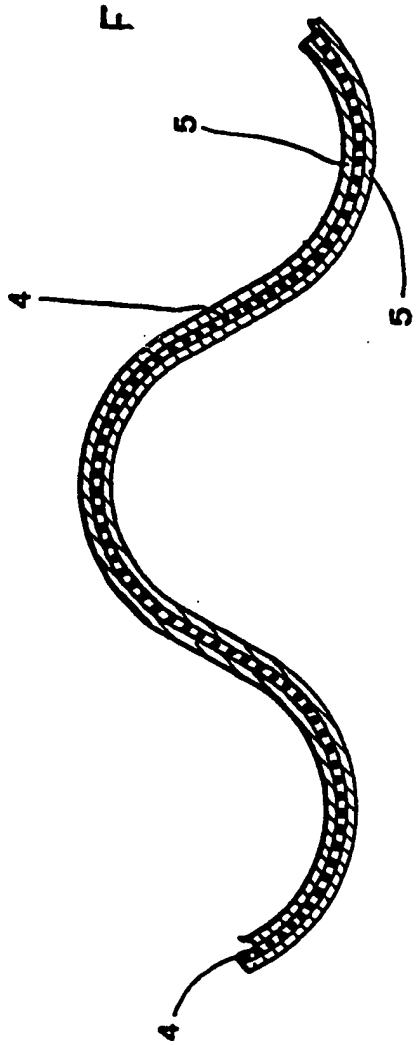


Fig.6



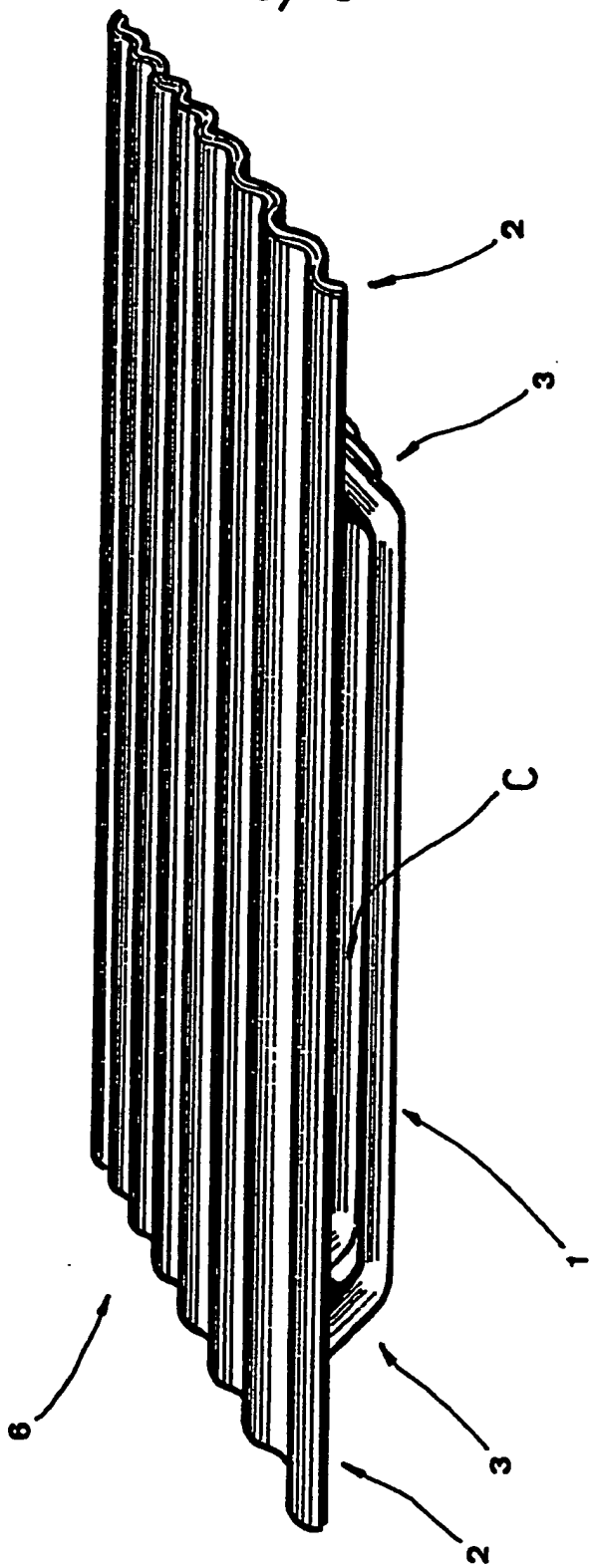


Fig.7

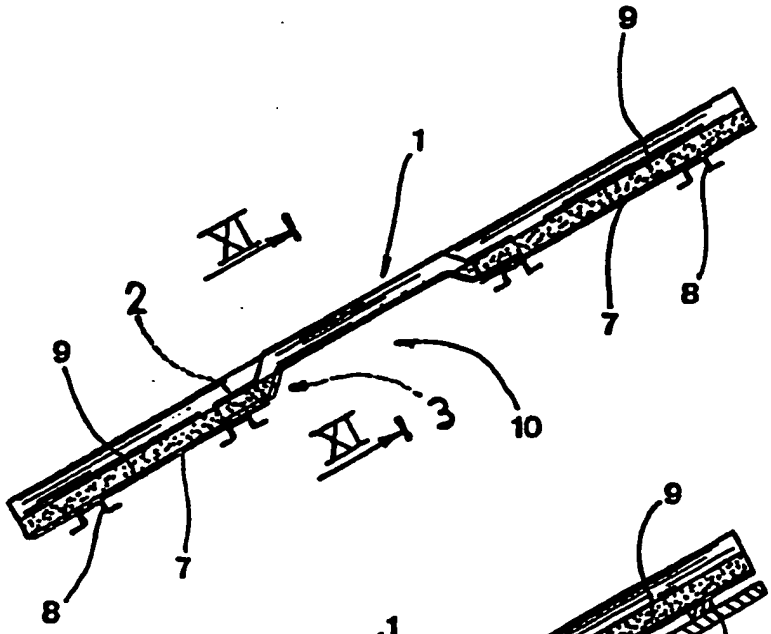


Fig.8

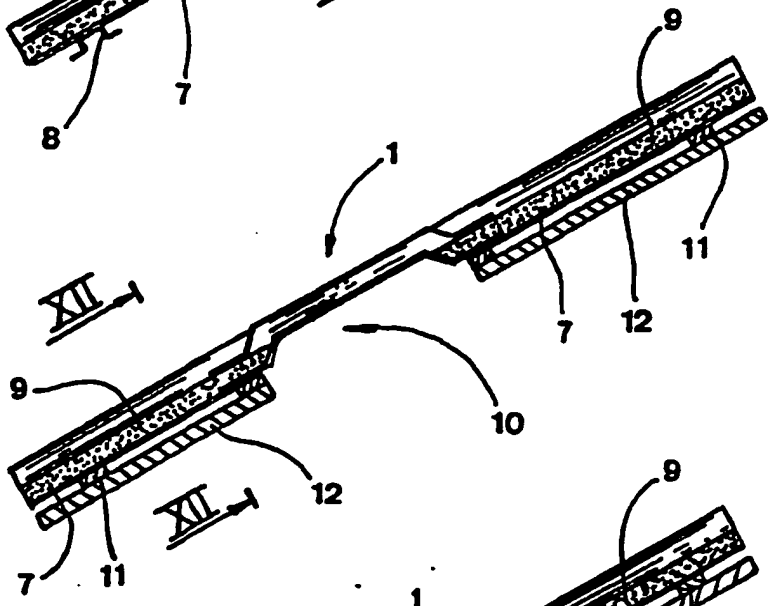


Fig.9

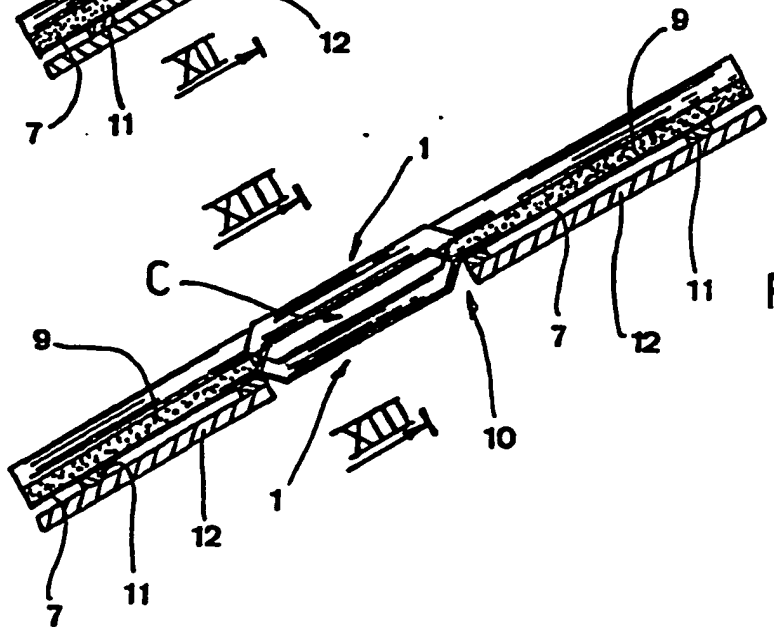


Fig.10

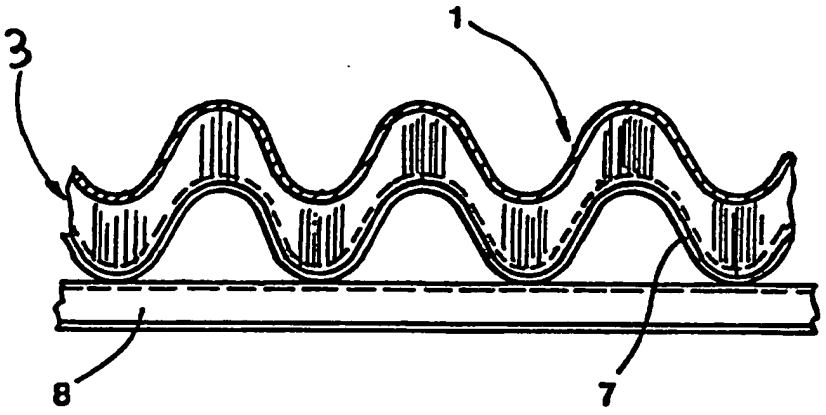


Fig.11

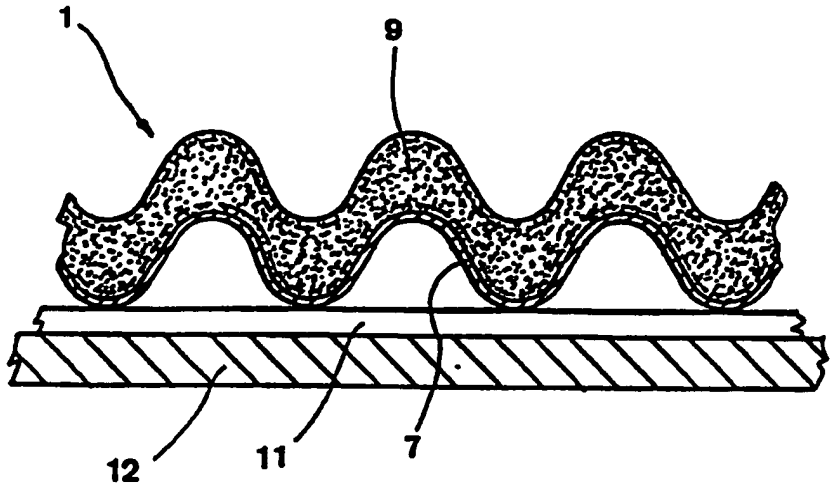


Fig.12

Fig.13

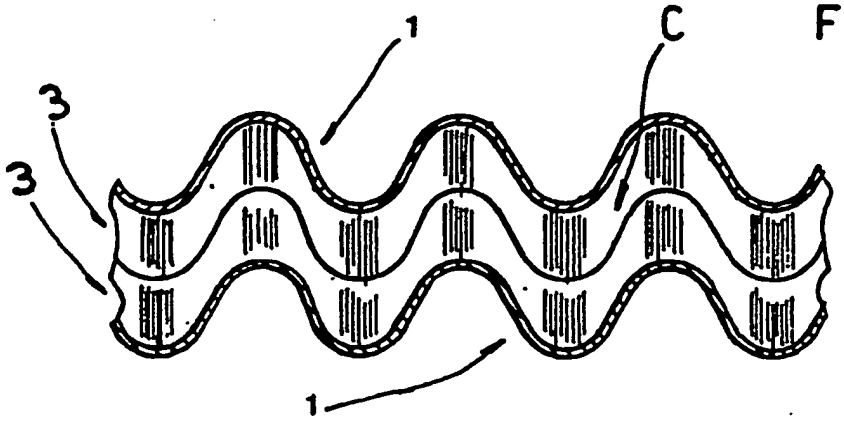


Fig.14

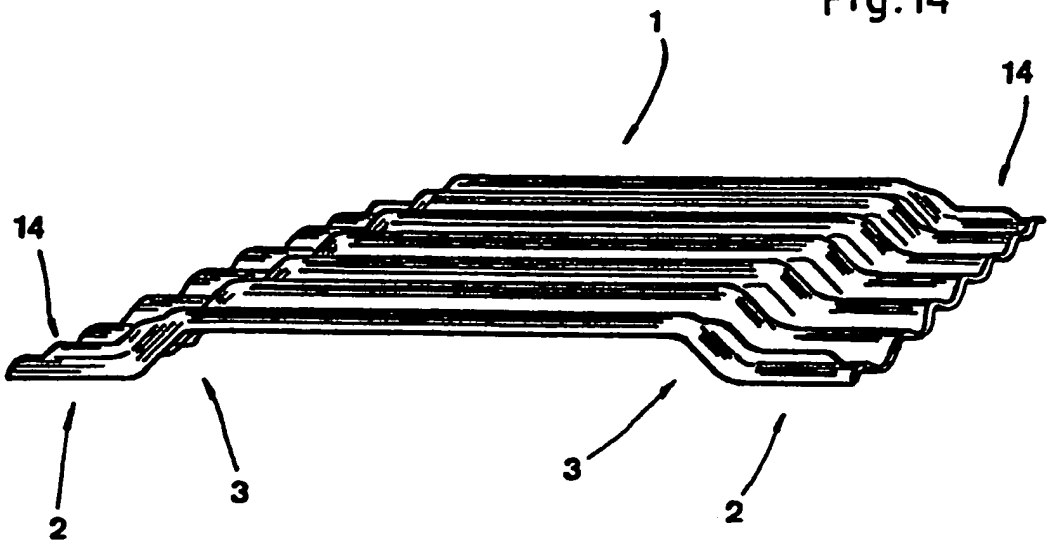


Fig.15

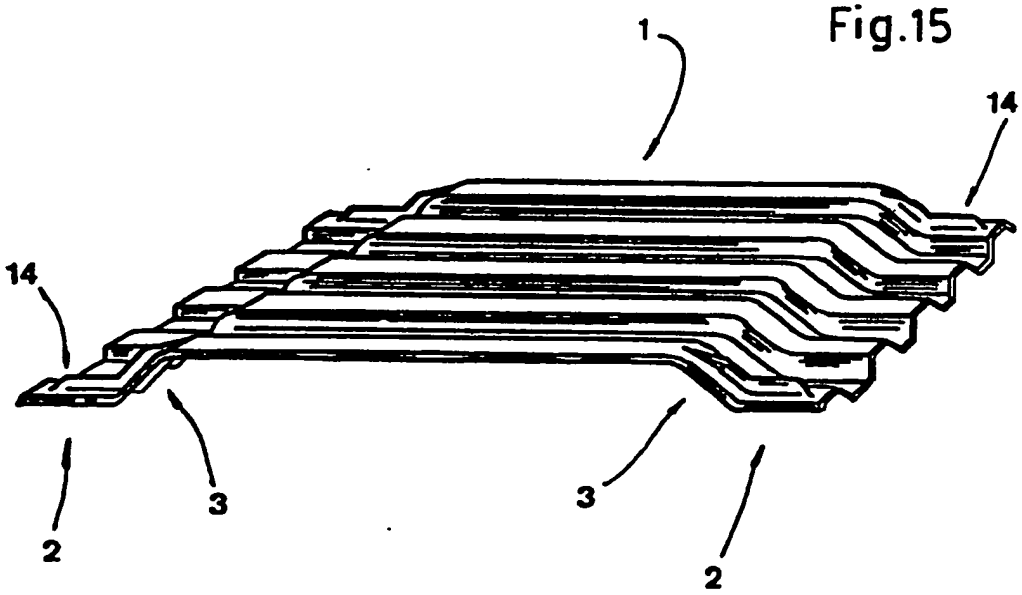


Fig.16

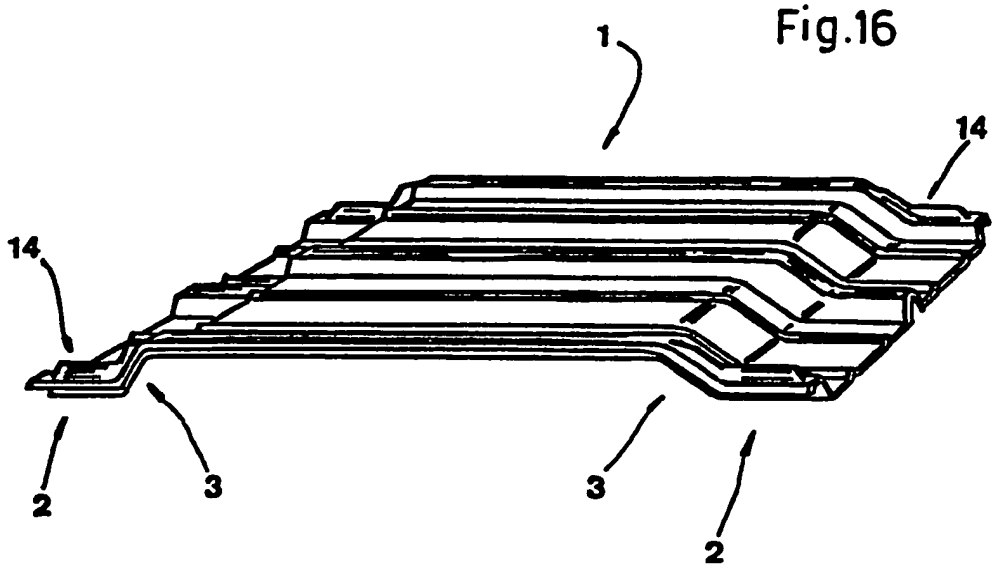


Fig.17

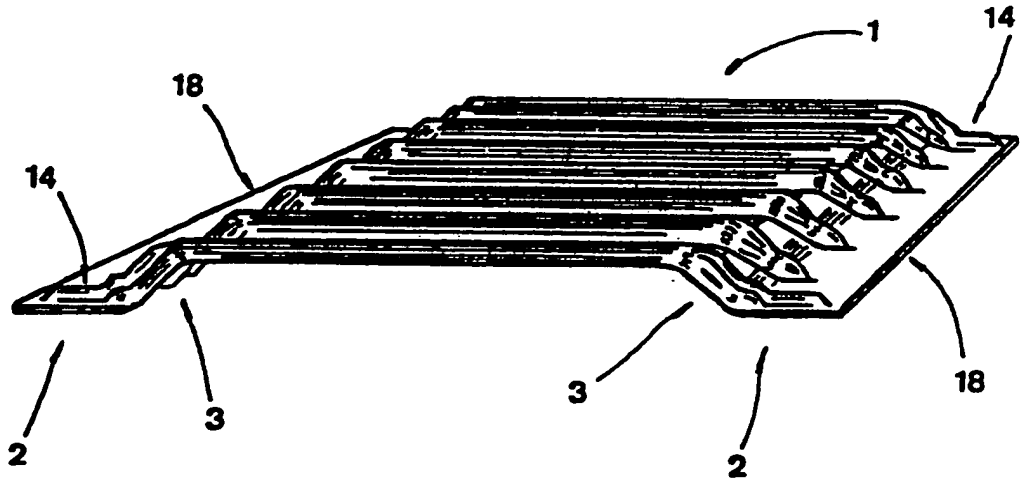


Fig.18

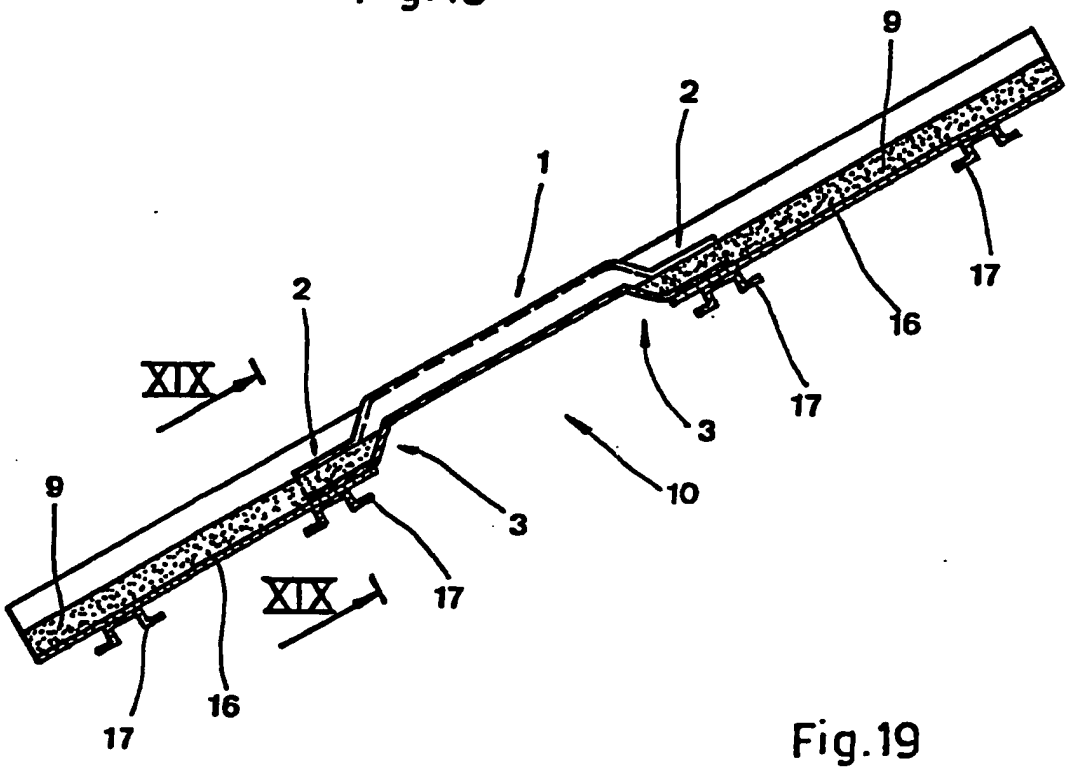
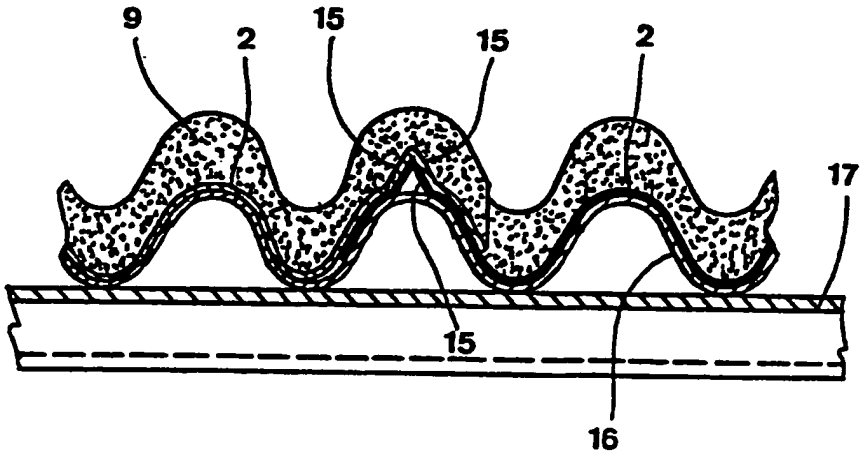


Fig.19



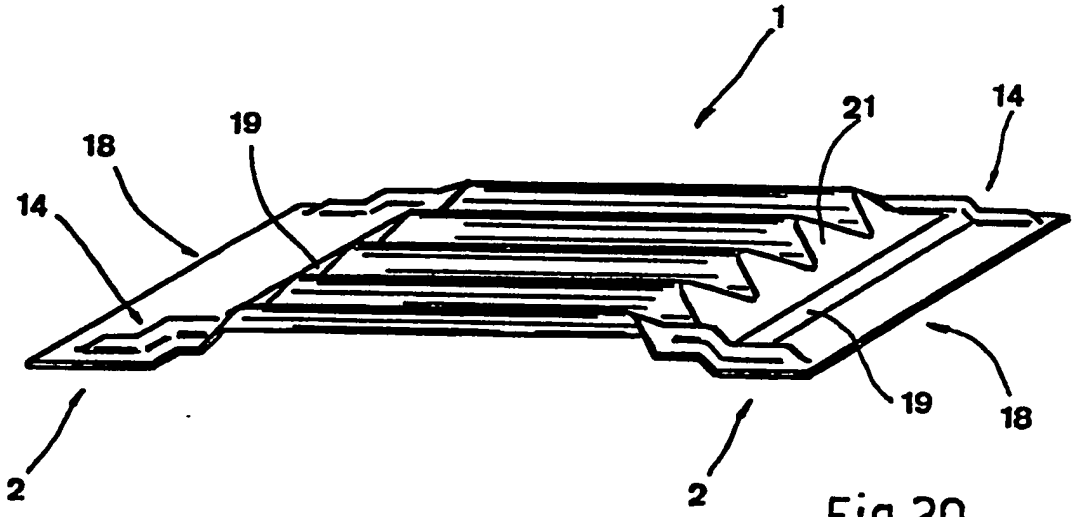


Fig.20

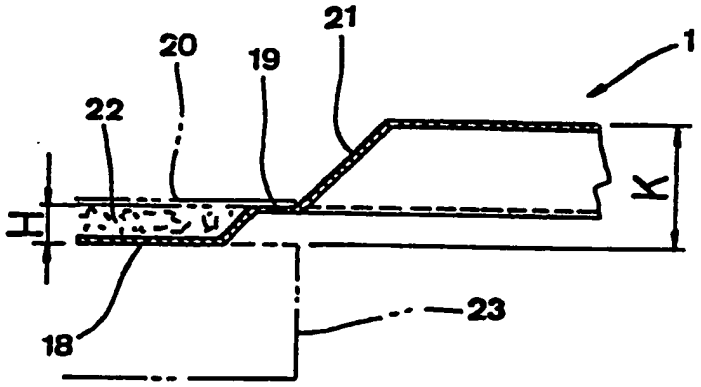


Fig.21

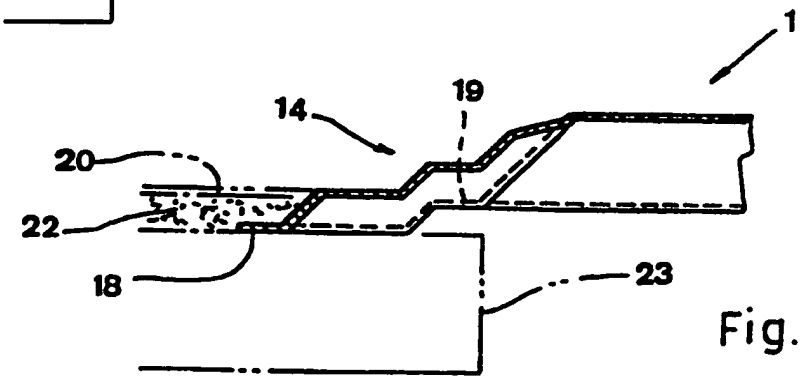


Fig.22

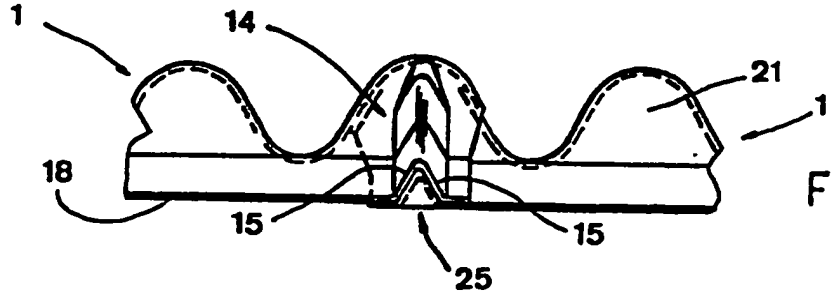


Fig.23

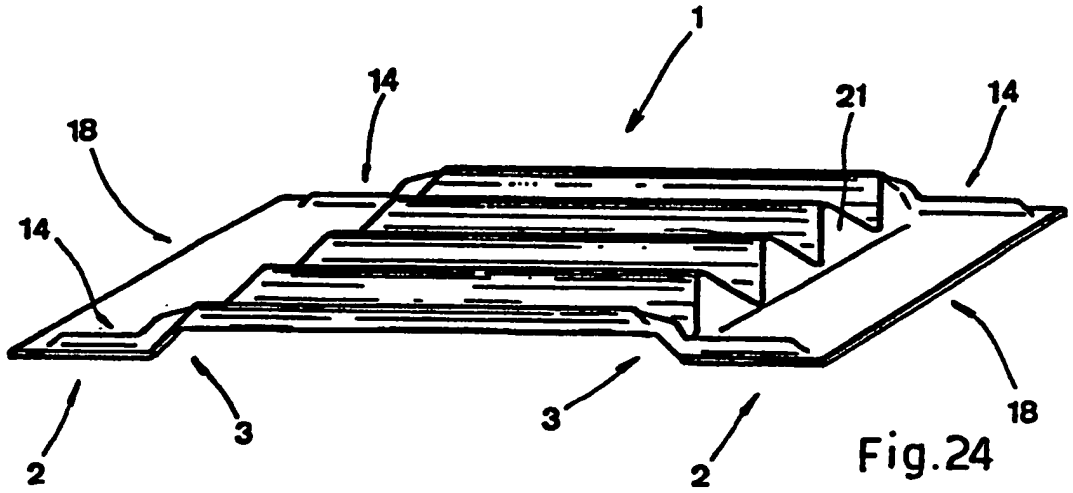


Fig.24

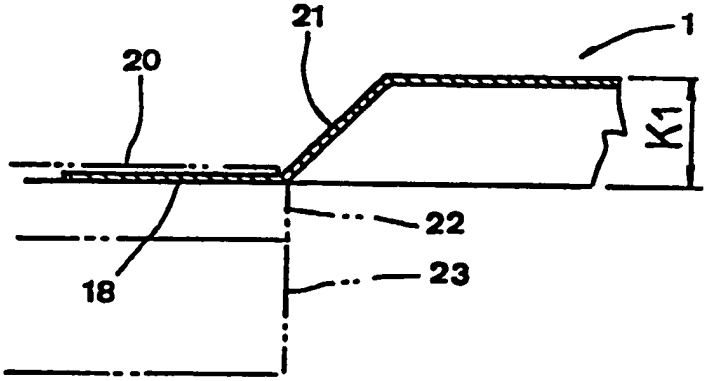


Fig.25

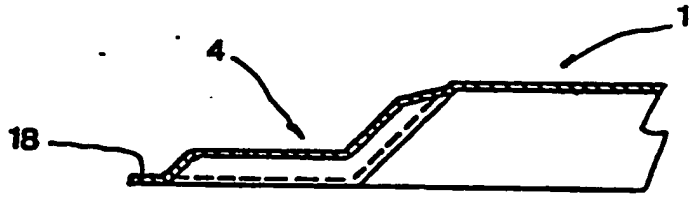


Fig.26

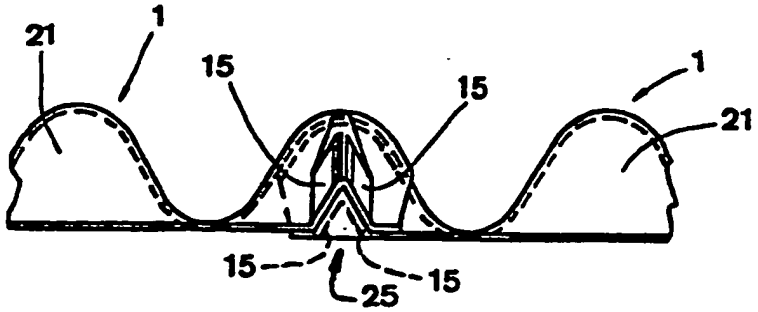


Fig.27

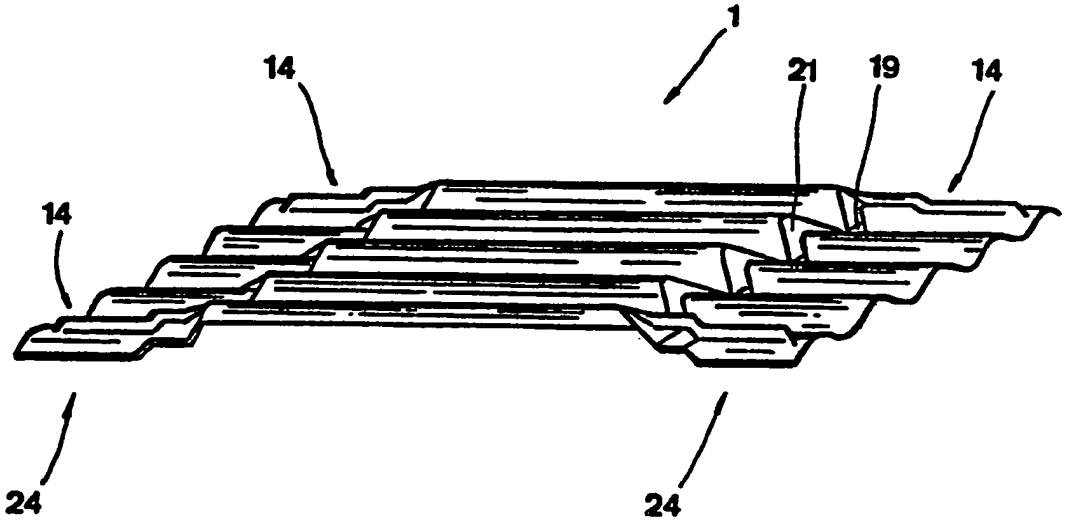


Fig.28

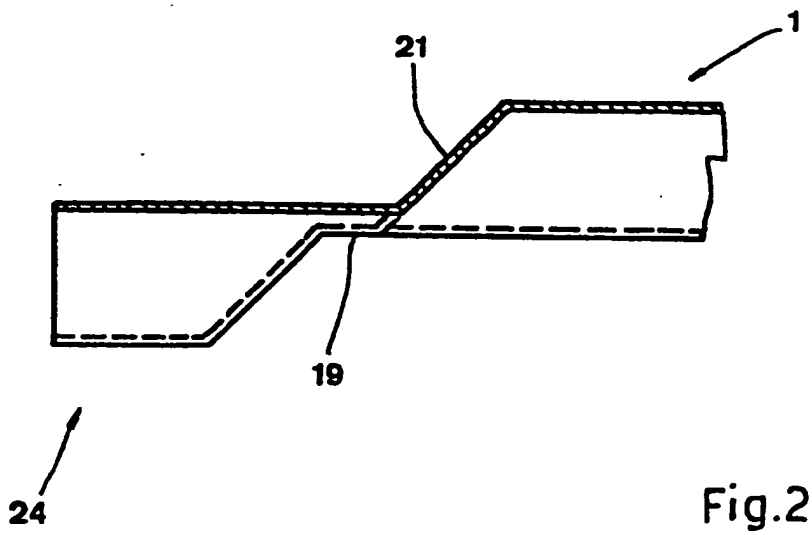


Fig.29

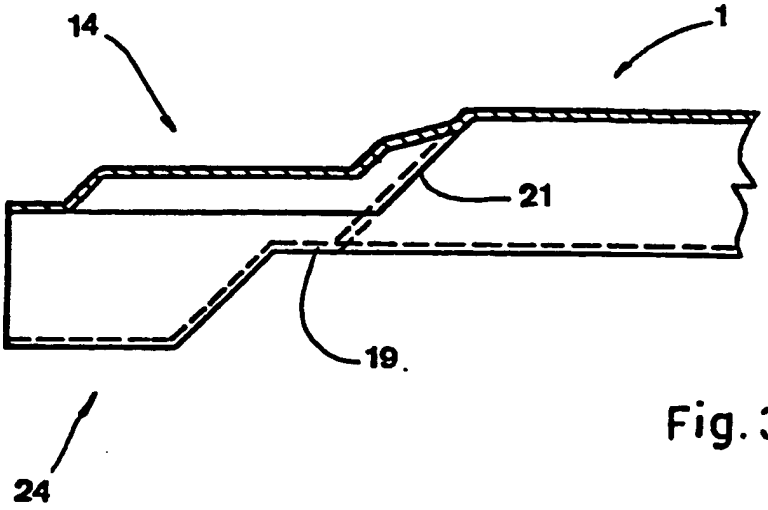


Fig. 30

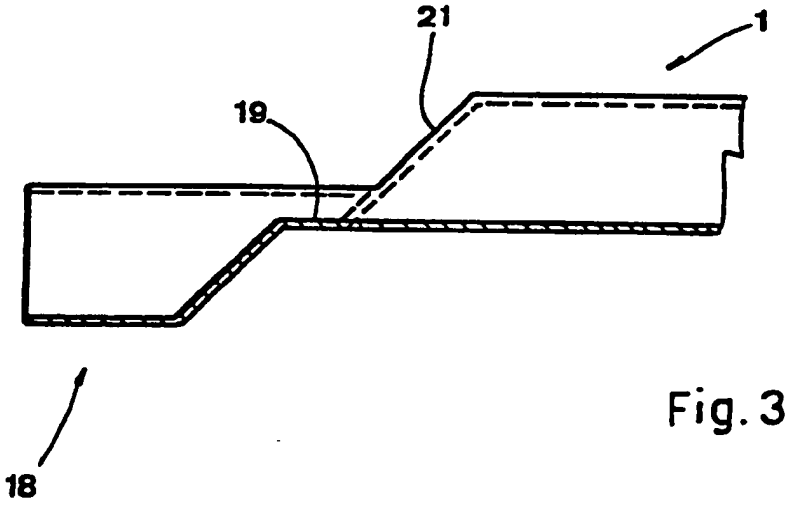


Fig. 31

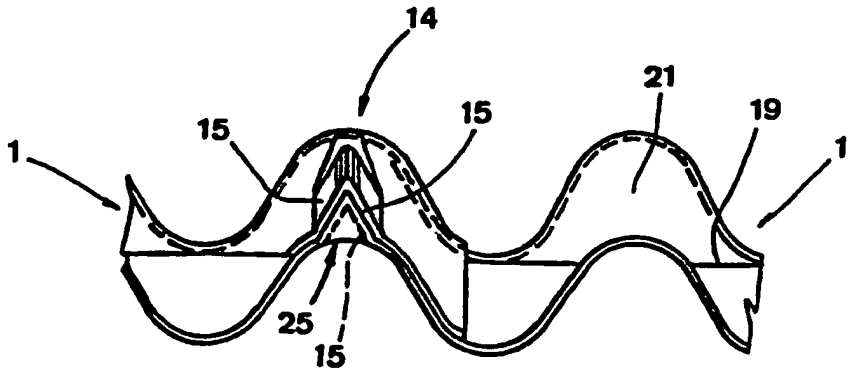


Fig. 32

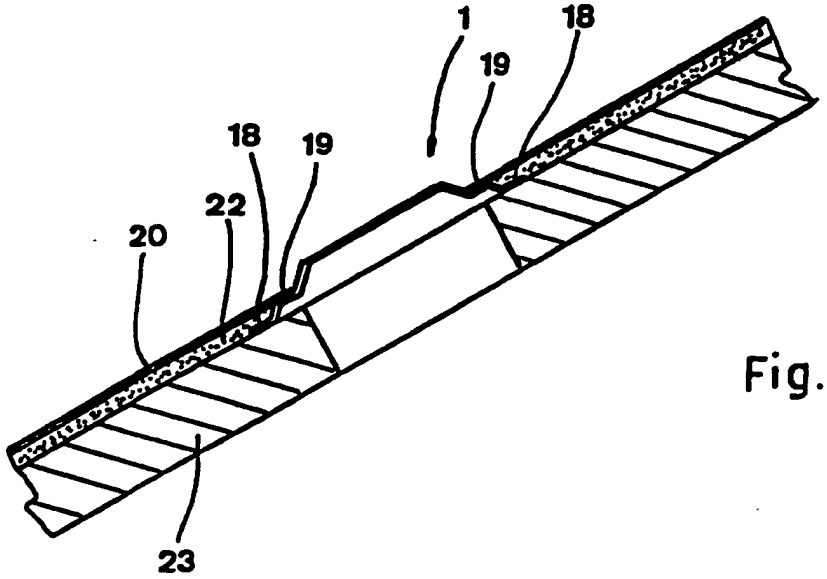


Fig.33

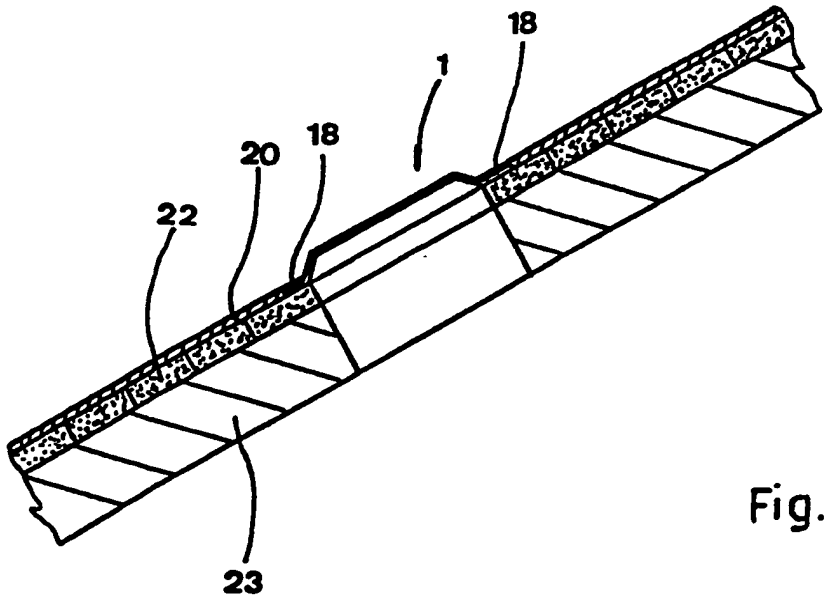


Fig.34

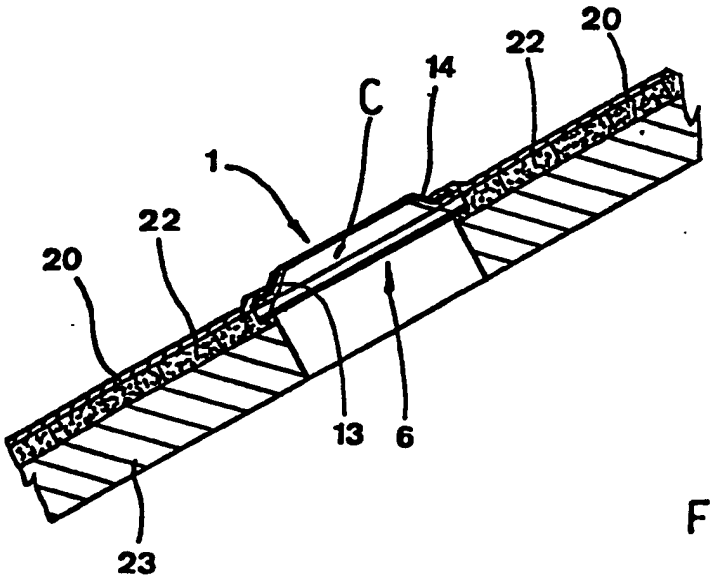


Fig.35

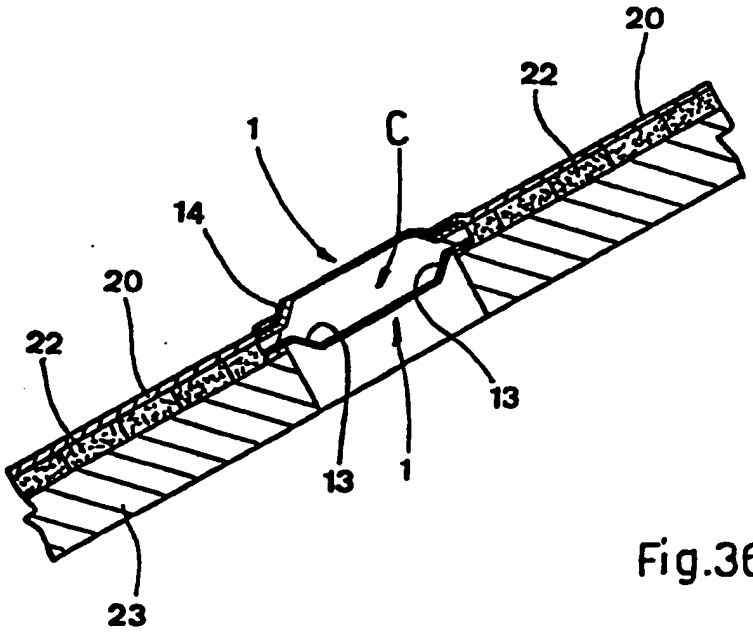


Fig.36

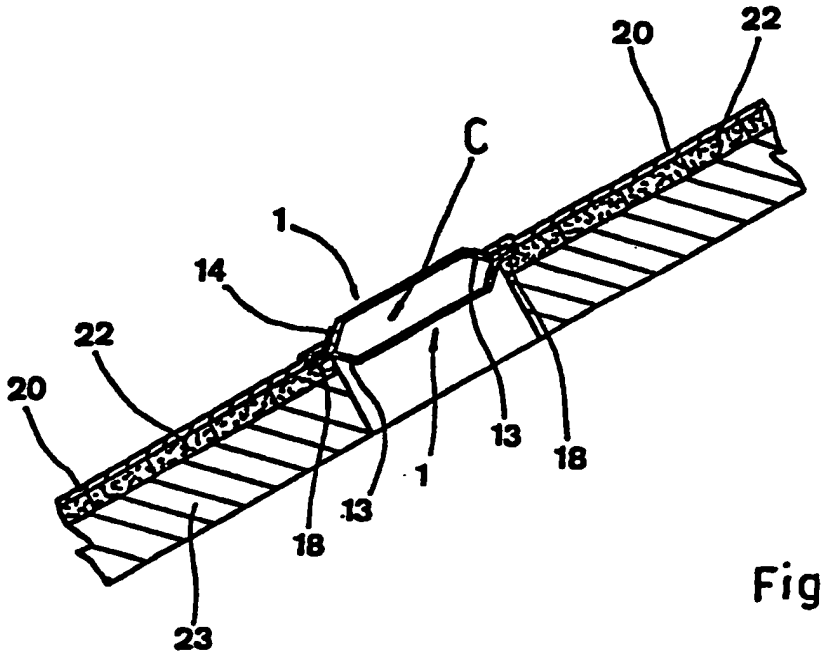


Fig.37

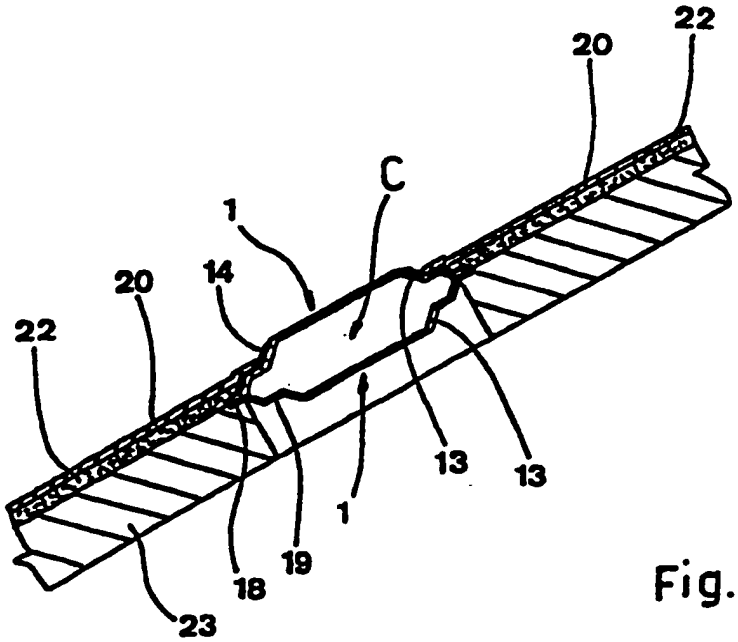


Fig.38

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 91/01518

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 E04D13/03; E04D3/28; E04C2/54

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	E04D ; E04C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X Y A	CH,A,418 589 (EVERS) 28 February 1967 see page 1, line 63 - page 2, line 73 see figures 1-5	1,3,7,8 2,4,10 12
Y	DE,A,2 060 756 (POLYPLASTIC) 29 June 1972 see the whole document	2
Y	GB,A,2 069 036 (REWSE) 19 August 1981 see page 1, line 110 - page 2, line 70; figures 1,2	4,10
X	BATIR vol. 124, October 1963, PARIS pages 14 - 15; 'Quoi de neuf?' Elément de bardage see page 15, column 1 - page 15, column 2	1,7,8,9, 12

-/--

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
05 NOVEMBER 1991	22. 11. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	HENDRICKX X.

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	DE,A,2 802 179 (HERZBERG) 26 July 1979 see page 5, line 3 - page 6, line 8; claim 1; figures 1-5	1-5,10
A	GB,A,1 259 500 (ROBERTSON) 5 January 1972 see page 1, line 88 - page 2, line 73; figures 1-5	4,6
A	GB,A,981 948 (AKRYLIC PLASTICS PROPRIETARY) 3 February 1965 see figures 1-4	1,6,11
A	US,A,2 918 023 (BETTCHER) 22 December 1959 see figures 1-4	1,2,6

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. EP 9101518 SA 50138

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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DE-A-2060756	29-06-72	BE-A- 776431 NL-A- 7104611	04-04-72 25-06-71
GB-A-2069036	19-08-81	None	
DE-A-2802179	26-07-79	None	
GB-A-1259500	05-01-72	None	
GB-A-981948		None	
US-A-2918023		None	